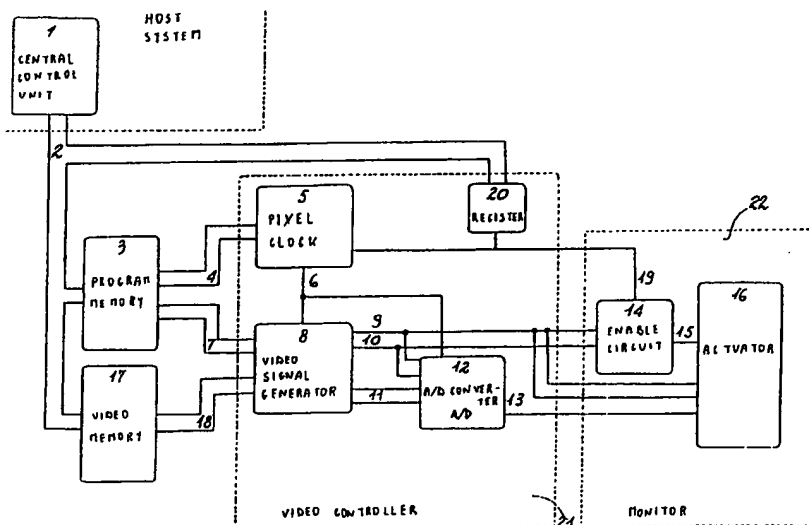




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/IT90/00036</p> <p>(22) International Filing Date: 30 March 1990 (30.03.90)</p> <p>(71) Applicant (for all designated States except US): TOWER TECH S.R.L. [IT/IT]; Via Sant'Andrea, 59, I-56100 Pisa (IT).</p> <p>(72) Inventors; and (75) Inventors/Applicants (for US only) : MACCARI, Antonio [IT/IT]; Via Bonanno, 109, I-56100 Pisa (IT). FRESA, Antonella [IT/IT]; Via San Donnino, 12, I-56100 Pisa (IT).</p> <p>(74) Agent: SASSATELLI, Franco; INIP, Via Ruggi, 5, I-40137 Bologna (IT).</p> <p>(81) Designated States: AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CF (OAPI patent), CG (OAPI patent), CH (European patent), CM (OAPI patent), DE (European patent)*, DK, DK (European patent), ES (European patent), FI, FR (European patent), GA (OAPI patent), GB (European patent), HU, IT (European patent), JP, KP, KR, LK, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL (European patent), NO, RO, SD, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US.</p>		<p>Published With international search report. With amended claims.</p>

## (54) Title: VIDEO DISPLAY FOR DIGITAL IMAGES AT HIGH FREQUENCY OF FRAME REFRESH



## (57) Abstract

The device enables to visualize the images registered in the video memory on the base of standard modes guaranteeing the compatibility with such informatic standards and improving the ergonomic characteristics of the display. The device consists of an intelligent programmable video controller (21) which generates the data and control signals for the cathode-ray tube monitor (22). The number of pixels on each line and the number of lines on each frame are defined by the standard graphics for Personal Computers, named VGA. Such standard is foreseen to use a frequency for frame refresh under 60 Hz for the resolution graphic modes (640 pixels for 480 lines) and equal to 70 Hz for the text modes. The invention device enables to obtain frame refresh frequency above 70 Hz for whatever mode, while respecting the compatibility with the standard VGA, by means of speeder pixel clocks (27 and 28), of the circuitry (5) used to select them, as well as for the monitor (22) capable of synchronizing on the frequencies generated for the ergonomic mode.

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"Video display for digital images at high frequency of frame refresh".

The present invention concerns a device able to display digital images formed by pixels ordered on lines and columns on an intelligent screen. This visualization consists of a set of pixel signals, characterized by the horizontal and vertical scanning frequency on the screen, according to pre-fixed resolutions on the base of the contents of a video memory which is periodically read by the pixel signal generator. The video controller includes a series of registers which must be programmed with the proper parameters according to the chosen type of resolution. The video contains the mechanisms for the horizontal and vertical synchronization and sweep, in order to synchronize on the pixel signal, generated by the video controller, and consequently to position the cathode-rays gun in the right position on the screen.

There are many video displays of the above described type. Some of such video controllers which use particular resolutions, a certain set of programmable registers and a video memory structured according to exact access mode, became a standard in the industrial branch of the personal computer.

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For these controllers a very large number of programs and applications has been developed with reference to them and, therefore it is essential for a personal computer to offer the compatibility with this "de facto standard". One of the most powerful and diffused standard is called VGA. The technical problem resolved by the present invention is to improve the visual characteristics of the image on the screen, still respecting the need of compatibility due to the VGA standard. There are many parameters that define the quality of the video image, and one of the most important is the frequency of the frame refresh. This frequency determines the time between two subsequent passages of the electron beam on the same point of the screen. More frequent is this passage, more stable the image appears to the eye of the observing operator, thus reducing the wear of the retina and of whole view apparatus.

The device is expressed through the operational components which operate in the numeral sequence of table 1. Through the communication channel of data and addresses 2, the central control unit 1 of the host system accesses to register 20 and gets the information on the monitor type to determine the program sequences to use for programming the timing registers of the video controller. Consequently, the said unit 1 accesses the program memory 3, to activate the program sequences 4 which inform the circuit of pixel clock selection 5. This circuit, on the base of this information as well as of the identification signal 19 coming from the monitor 22, selects the pixel clock 6, which will temporize the operations of the video signal generator 8 and of the digital-to-analog converter of the video signal 12. The same central control unit 1 of the host system, through the same communication channel of data and addresses 2, accesses to the same program

55 memory 3 to activate the sequences of program 7, which,  
with the programming sequences required by the set video  
mode, initialize the registers of the video signal generator  
8. This video signal generator 8 scans the video memory  
17, previously filled by the central control unit 1 through  
60 the data and addresses channel 2, to obtain the information  
through the data and addresses channel 18. The same video  
signal generator 8 will transform these information into  
digital video signals and will put them on the data channel  
11 towards the D/A converter 12, as well as will generate  
65 the horizontal 9 and vertical 10 sync signal which are sent  
both to the D/A converter 12, to interpret the data flow  
of channel 11, to the mode detector circuit 14, which stays  
in the video module, and to the circuitry of the monitor.  
For the timing of the video signals and synchronisms the  
70 video signal generator 8 will use the pixel clock 6 as the  
time base, and the contents of its timing registers, which  
are programmed by the program sequences 7, will define the  
characteristics of these timings. The mode detector circuit  
14 arranges to generate the information 15 for the synchroniza-  
75 tion circuits and for the actuators of the cathode-ray beam  
16, in order to select the operation of higher frequencies  
than the standard one.

A preferred execution form of the circuit for the pixel  
80 clock selection is represented in table 2, for an exemplifying  
but not limiting purpose. Through the data and addresses  
channel 4, the selection register 23 for the ergonomic or  
the standard VGA mode is initialized. The coincidence (logical  
AND) of the information coming from the register 23 and  
85 of the identification signal 19 coming from the monitor,  
which indicates whether the monitor is able to support the  
high frequency refresh mode, is sent on the INPUT selection

signal (A/B) of the MULTIPLEXER 24. The MULTIPLEXER 24 in  
INPUT has the standard clocks 25 and 26, respectively like  
90 25,275 MHz and 28,322 MHz, and the speeder clocks 27 and  
28 used for the ergonomic mode. On the OUTPUT lines 29 and  
30 the MULTIPLEXER 24 selects the pixel clock for the alpha-  
numerical and graphic modes which have different horizontal  
resolutions and, therefore, different pixel clocks. It must  
95 be noted that the monitor, through the identification signal  
19, will state to the video controller that it can support  
the ergonomic mode, when it is able to accept two horizontal  
frequencies equal to 31,5 KHz, standard VGA frequency and  
at least 35,5 KHz required for the ergonomic VGA mode. The  
100 pixel clocks 29 and 30 become the INPUT for a second MULTIPLE-  
XER 31 which in OUTPUT selects the pixel clock 6 on the  
base of the INPUT selection signal coming from the register  
32 which is programmed through the data and addresses channel  
4 and which indicates whether the current mode is alpha-  
105 numerical or graphic.

Alternatively, the register 32 could be replaced by a register  
which memorizes the information of a user accessible switch,  
who selects between standard VGA video mode and ergonomic  
110 VGA video mode.

The present device is illustrated in a merely indicative  
way by the drawings of the tables 1 and 2. With reference  
to these tables, fig. 1 is the scheme of the different operati-  
115 ve components, whereas fig. 2 is a preferred execution form  
for the selection circuit of pixel clock 5.

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Claim.

1) Video display for digital images at high frequency of frame refresh, characterized by the fact that through the communication channel of data and addresses (2) the central control unit (1) of the host system accesses to register (20) and gets the information on the monitor type to determine the program sequences to use for programming the timing registers of the video controller. Consequently, the said unit (1) accesses the program memory (3) to activate the program sequences (4) which inform the circuit of pixel clock selection (5). This circuit, on the base of this information as well as of the identification signal (19) coming from the monitor (22), selects the pixel clock (6), which will temporize the operations of the video signal generator (8) and of the digital-to-analog converter of the video signal (12). The same central control unit (1) of the host system, through the same communication channel of data and addresses (2), accesses to the same program memory (3) to activate the sequences of program (7), which, with the programming sequences required by the set video mode, initialize the registers of the video signal generator (8). This video signal generator (8) scans the video memory (17), previously filled by the central control unit (1) through the data and addresses channel (2), to obtain the information through the data and addresses channel (18). The same video signal generator (8) will transform these information into digital video signals and will put them on the data channel (11) towards the D/A converter (12), as well as will generate the horizontal (9) and vertical (10) sync signal, which are sent both to the D/A converter (12), to interpret the data flow of channel (11), to the mode detector circuit (14), which stays in the video module, and to the circuitry of the

monitor. For the timing of the video signals and synchronisms,  
35 the video signal generator (8) will use the pixel clock  
(6) as the time base, and the contents of its timing registers,  
which are programmed by the program sequences (7),  
will define the characteristics of these timings. The  
mode detector circuit (14) arranges to generate the information  
40 tion (15) for the synchronization circuits and for the  
actuators of the cathode-ray beam (16), in order to select  
the operation at higher frequencies than the standard one.

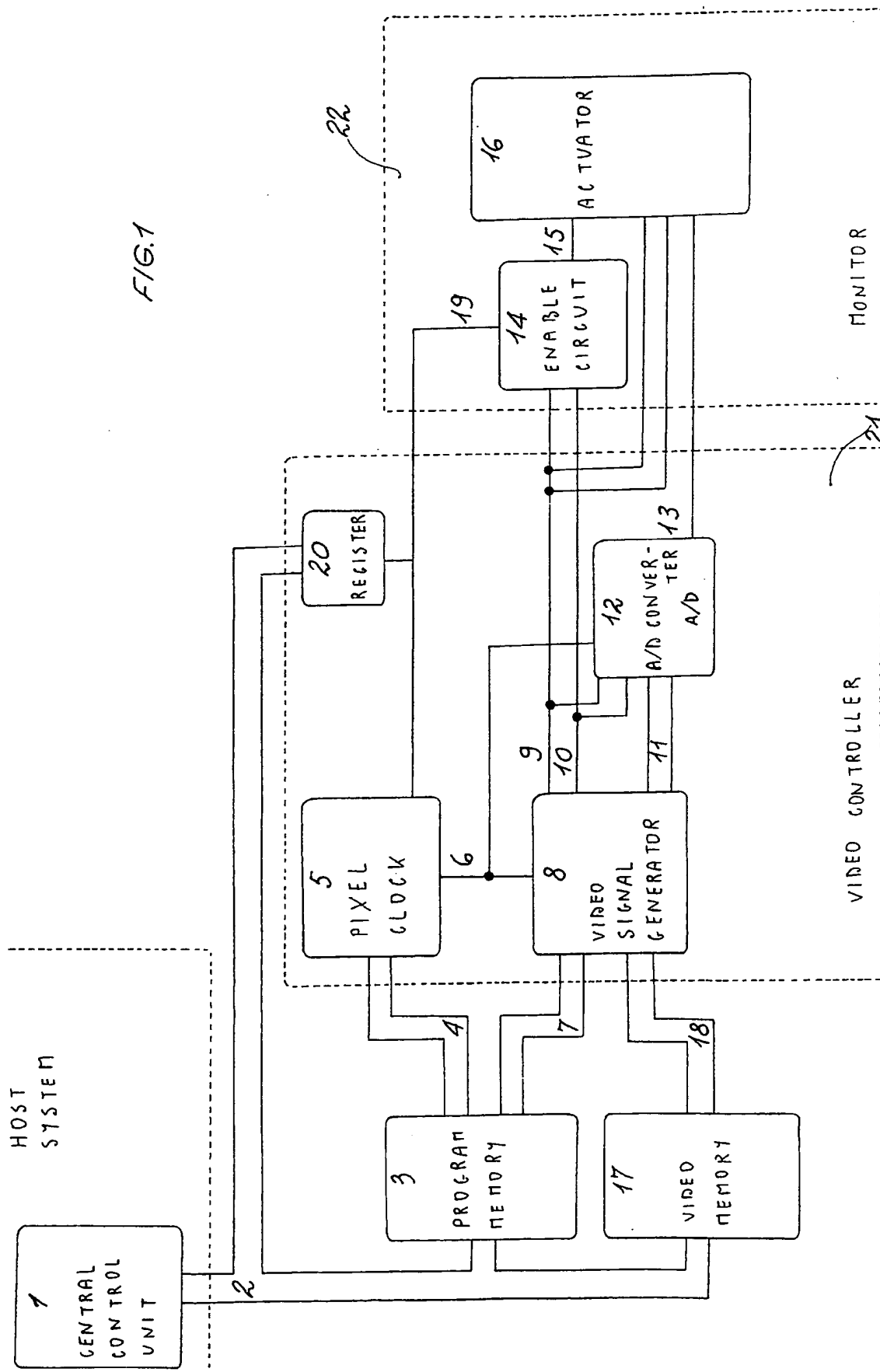


## AMENDED CLAIMS

[received by the International Bureau on 30 July 1991 (30.07.91)  
original claim 1 replaced by amended claim 1 (2 pages)]

1) A video display adapter for displaying digital images at high frequency of frame refresh, associated to the communication channel (2), for data and addresses of a central control unit (1) of a host system, arranged to have a register (20) to get information to determine the program sequences for programming timing registers of a video controller, said unit (1) having access to the program memory (3) to activate the program sequences (4) which inform the circuit (5) for pixel clock selection, said circuit (5) on the basis of such information as well as of an identification signal (19) coming from a monitor (22) selecting the pixel clock (6), which will give timing of the operations of a video signal generator (8) and of a digital-to-analog converter (22) for the video signal, said central control unit (1) of a host system, through the same communication channel of data and addresses (2) having access to said program memory (3) for activating the sequences of program (7), which, with the programming sequences required by the set video mode, initializes the registers of said video signal generator (8), said video signal generator performing the scanning of a video memory (17), previously filled by said central control unit (1) through said data and addresses channel (18), said video signal generator (8) being arranged to transform this information into digital video signals put on a data channel (11) towards the D/A converter (12), as well as to generate horizontal (9) and vertical (10) synchronism signals, both sent to said D/A converter (12), to interpret the data flow of channel (11), to a mode detector circuit (14), located in a video module, and to the circuitry of the monitor (16); the timing of the video signals and synchronisms, the video signal generator (8) being controlled by the pixel clock (6) as time base, and the contents of its timing registers, which are programmed by the program sequences (7), defining the characteristics of these timings, said mode detector circuit

(14) being arranged to generate the information (15) for the synchronization circuits and for the actuators of a cathode-ray display (16), in order to select the operation at higher refresh frequencies than the standard ones.



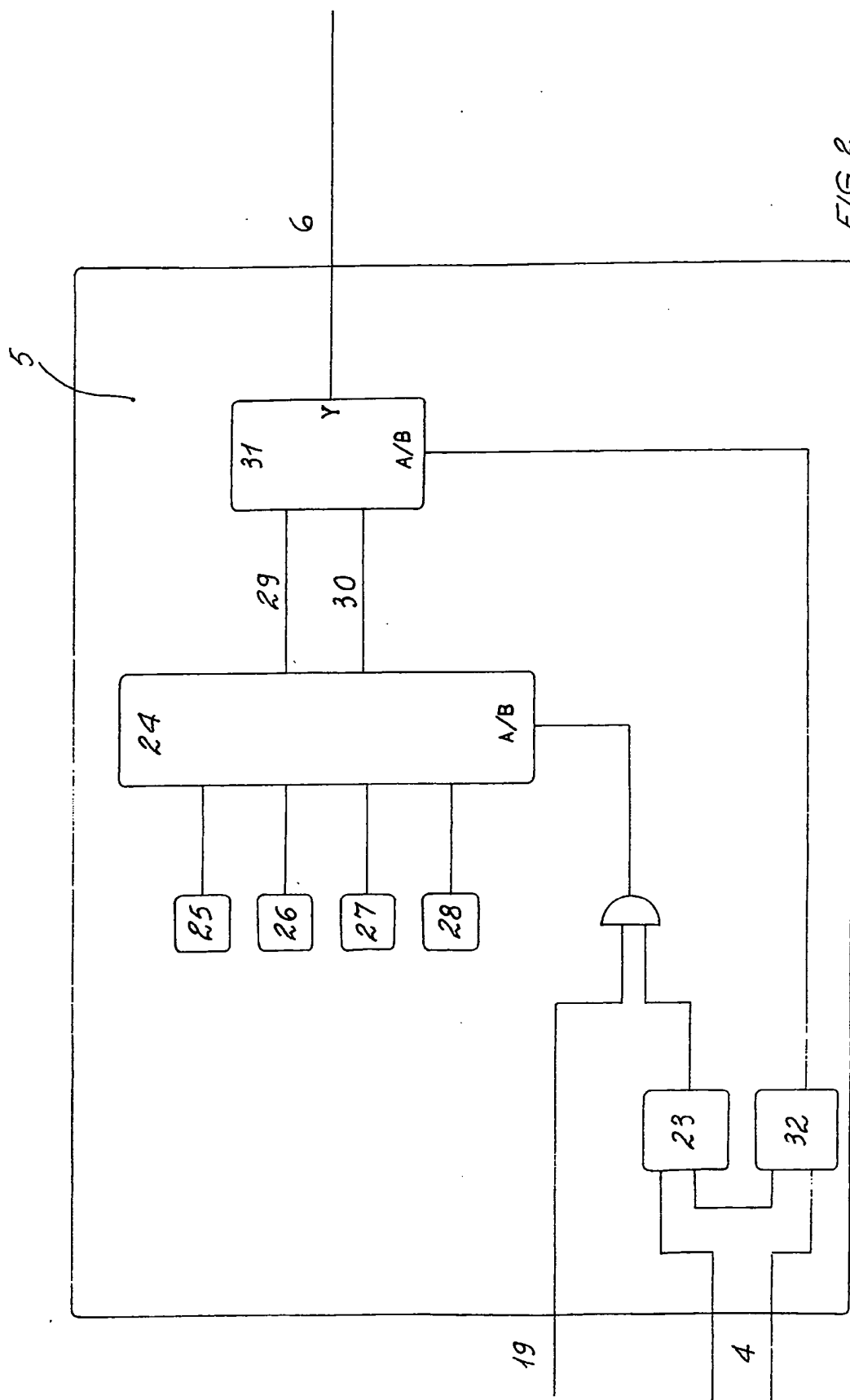


FIG. 2

# INTERNATIONAL SEARCH REPORT

International Application No PCT/IT 90/00036

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup> According to International Patent Classification (IPC) or to both National Classification and IPC IPC <sup>5</sup> : G 09 G 1/16																	
<b>II. FIELDS SEARCHED</b> <div style="text-align: right; font-size: small;">Minimum Documentation Searched <sup>7</sup></div> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;">Classification System</td> <td style="width: 50%; border: none;">Classification Symbols</td> </tr> <tr> <td style="border: none; padding: 10px 0 0 20px;">IPC<sup>5</sup></td> <td style="border: none; padding: 10px 0 0 20px;">G 09 G</td> </tr> </table> <div style="text-align: center; font-size: x-small; margin-top: 10px;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup></div>			Classification System	Classification Symbols	IPC <sup>5</sup>	G 09 G											
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IPC <sup>5</sup>	G 09 G																
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b> <table border="1" style="width: 100%; border-collapse: collapse; font-size: x-small;"> <thead> <tr> <th style="width: 10%;">Category <sup>10</sup></th> <th style="width: 70%;">Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup></th> <th style="width: 20%;">Relevant to Claim No. <sup>13</sup></th> </tr> </thead> <tbody> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>IBM Technical Disclosure Bulletin, volume 29, no. 11, April 1987, IBM Corp., (Armonk, NY, US), "Programmable dot clock for video adapter", pages 4859-4860 see the whole article --</td> <td style="text-align: center; vertical-align: top;">1</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>Research Disclosure, no. 256, August 1985, Emsworth, (Hampshire, GB), "Monitor-type sensing circuit" page 414 see the whole article --</td> <td style="text-align: center; vertical-align: top;">1</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>US, A, 4616260 (DOUGLAS A. ERWIN) 7 October 1986 see abstract; column 2, lines 5-32 --</td> <td style="text-align: center; vertical-align: top;">1</td> </tr> <tr> <td style="text-align: center; vertical-align: top;">A</td> <td>US, A, 4905167 (SHIGEMITSU YAMAOKA) 27 February 1990 see abstract; column 2, lines 3-35 -----</td> <td style="text-align: center; vertical-align: top;">1</td> </tr> </tbody> </table> <div style="font-size: x-small; margin-top: 10px;"> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><sup>10</sup> Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"G" document member of the same patent family</p> </div> </div> </div>			Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>	A	IBM Technical Disclosure Bulletin, volume 29, no. 11, April 1987, IBM Corp., (Armonk, NY, US), "Programmable dot clock for video adapter", pages 4859-4860 see the whole article --	1	A	Research Disclosure, no. 256, August 1985, Emsworth, (Hampshire, GB), "Monitor-type sensing circuit" page 414 see the whole article --	1	A	US, A, 4616260 (DOUGLAS A. ERWIN) 7 October 1986 see abstract; column 2, lines 5-32 --	1	A	US, A, 4905167 (SHIGEMITSU YAMAOKA) 27 February 1990 see abstract; column 2, lines 3-35 -----	1
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<b>IV. CERTIFICATION</b> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; padding: 5px;">           Date of the Actual Completion of the International Search  <div style="text-align: center;">20th November 1990</div> </td> <td style="width: 50%; border: none; padding: 5px;">           Date of Mailing of this International Search Report  <div style="text-align: center;">18. 12. 90</div> </td> </tr> <tr> <td style="width: 50%; border: none; padding: 5px;">           International Searching Authority  <div style="text-align: center;">EUROPEAN PATENT OFFICE</div> </td> <td style="width: 50%; border: none; padding: 5px;">           Signature of Authorized Officer  <div style="text-align: center;">H. Ballesteros </div> </td> </tr> </table>			Date of the Actual Completion of the International Search <div style="text-align: center;">20th November 1990</div>	Date of Mailing of this International Search Report <div style="text-align: center;">18. 12. 90</div>	International Searching Authority <div style="text-align: center;">EUROPEAN PATENT OFFICE</div>	Signature of Authorized Officer <div style="text-align: center;">H. Ballesteros </div>											
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4616260	07-10-86	None	
US-A- 4905167	27-02-90	JP-A- 63147189	20-06-88

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